

## PATENT APPLICATION TRANSMITTAL LETTER

THE COMMISSIONER OF PATENTS AND TRADEMARKS

Docket No. 9100-1

Transmitted herewith for filing of the patent application of

Richard Banfield Hicksfor: ELECTRICITY GENERATION FOR PEDALLED VEHICLES

Enclosed are:

- ☒ Signed Declaration  
☐ 1 Sheet of drawing (3 sets)  
☒ Recordation Form Cover Sheet  
☒ An assignment of the invention to:  
Pedalite Limited  
☒ Verified Statement Claiming Small Entity Status

## CLAIMS AS FILED

FOR	NO. FILED	NO. EXTRA
Basic Fee		
Total Claims	-20- 20	0
Indep Claims	-3- 2	0
multiple dependent claim present		

If the difference in Col. 1 is less than zero,  
enter "0" in Col. 2

## Small Entity

RATE	FEE
	\$380
x \$ 9 =	\$ 0
x \$39 =	\$ 0
x \$130 =	\$ 0
TOTAL	\$380

## Other than a Small Entity

RATE	FEE
	\$760
x \$18 =	\$ 0
x \$78 =	\$ 0
x \$260 =	\$ 0
TOTAL	\$

assignment recordal fee

\$ 40  
\$420

— Please charge my Deposit Account No. 17-0055 in the amount  
of \$ \_\_\_\_\_.

☒ A check in the amount of \$ 420.00 is enclosed.

☒ The Commissioner is hereby authorized to charge payment of the  
following fees associated with this communication or credit any  
overpayment to Deposit Account No. 17-0055. A duplicate of this  
sheet is enclosed.

☒ Any additional filing fees required under 37 C.F.R. 1.16.

— Any patent application processing fees under 37 C.F.R. 1.17.

Date

Signature

**VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) and 1.27(c))--SMALL BUSINESS**

Docket Number (Optional)  
9100-1

Applicant or Patentee: J Richard Banfield Hicks

Serial or Patent No.: \_\_\_\_\_

Filed or Issued: \_\_\_\_\_

Title: "Electricity generation for pedalled vehicles"

I hereby declare that I am

☐ the owner of the small business concern identified below:

☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF SMALL BUSINESS CONCERN: Pedalite Limited

ADDRESS OF SMALL BUSINESS CONCERN: 26 Latchmere Lane, Kingston,  
Surrey KT2 5PD, United Kingdom

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention described in:

☒ the specification filed herewith with the title as listed above.

☐ the application identified above.

☐ the patent identified above.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention must file separate verified statements averring to their status as small entities and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each such person, concern or organization having rights in the invention is listed below:

☒ No such person, concern, or organization exists.

☐ Each such person, concern or organization is listed below.

FULL NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application of patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Richard Banfield Hicks

TITLE OF PERSON OTHER THAN OWNER Director

ADDRESS OF PERSON SIGNING 26 Latchmere Lane, Kingston, Surrey KT2 5PD  
United Kingdom

SIGNATURE Richard Banfield Hicks

DATE 7 January 1999

QBWPB\132597.1

Richard Banfield Hicks

# "ELECTRICITY GENERATION FOR PEDALLED VEHICLES"

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

This invention relates to electricity generation for pedalled vehicles and more particularly to improvements in the generation of electricity by pedal power and its use in contributing to road safety.

### 2. Description of the Prior Art

Pedalled vehicles such as bicycles are particularly vulnerable to road accidents not only because they offer little or no protection to the rider but primarily because the drivers of other vehicles may not see them, especially in the dark or poor weather conditions. It is of course mandatory in most countries for bicycles to use lights in the dark and most are equipped with reflectors, but conventional lighting systems leave much to be desired. If lighting is by dry batteries these may fail or the rider may simply fail to turn them on. The drawbacks of conventional generators, either incorporated in a wheel hub or driven by a tyre, include the fact that they make pedalling harder, which is a disincentive to using them, and that the illumination they provide ceases as soon as the bicycle stops, representing a considerable danger e.g. when the bicycle is waiting at traffic lights or at a road junction. Reflectors are of course only effective when illuminated by the oncoming vehicle, which will not occur if the latter has no adequate lights or is approaching at an angle.

In recent years LEDs (light emitting diodes) have been used either instead of or to supplement light bulbs. Taking advantage of their relatively low power consumption it is practicable to have them permanently in use, even in daylight. Flashing LEDs attract attention and it has been appreciated that it is particularly advantageous to mount them upon the pedals. Their rotary motion attracts attention and moreover an oncoming driver can judge his orientation relative to the bicycle by whether the rotating LEDs describe a circle (when at right angles) a vertical line (when in front or behind) or an ellipse when approaching at an angle. Direction can of course be judged by the colour of the visible LEDs, usually red indicating

the rear of the bicycle and a white or green light indicating that it is approaching.

While the use of LEDs on the pedals of a bicycle is highly advantageous, if their power is derived from a dry battery this may fail unbeknownst to the rider and in any event the use of dry batteries is undesirable if it can be avoided both because of their high cost and the environmental problems associated with their disposal.

Japanese Patent Publication No. 07291174A and United States Patent No. 5662405 propose the modification of a bicycle pedal to serve as a generator of electricity to illuminate LEDs mounted on the frame or tread portion of the pedal. Permanent magnets are attached to the pedal shaft or spindle and the pedal frame or tread portion is provided with windings or solenoids and relative rotation between the permanent magnets and the windings as relative rotation occurs between the pedal spindle and tread portion generates current by magnetic induction on the same principles as in the case of a conventional bicycle dynamo.

The voltage generated by an inductance generator is a function of the number of windings of the stator and the speed of rotation of the rotor. The essential weakness of a system such as described in the said Japanese patent publication resides in the relatively very low speed of rotation of the rotor or spindle under normal circumstances. A pedal spindle will rotate only once relative to the tread portion or frame mounted upon it for every revolution of the crank on which the spindle is mounted. A cyclist typically will pedal at between 30 and 60 revolutions of the pedal crank per minute. Japanese Patent publication No. 07291174A recognises this problem but the only solution proposed is to increase the number of windings. The present Applicants have calculated that this is impracticable because it would increase unacceptably the cost and/or size of the stator component, bearing in mind that this is to be incorporated in the tread portion of a pedal.

Another disadvantage of using the pedal spindle itself as the rotor is that it, and the associated bearings, will be subjected to the wear and abuse in service which pedal spindles usually experience. It is preferable that

the relatively delicate and accurate bearings of a generator should not be directly exposed to such treatment.

#### SUMMARY OF THE INVENTION

A principal object of the present invention is to improve upon the proposals of the said Japanese Patent publication and offer solutions to the problems associated therewith.

In accordance with the invention there is provided electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, wherein at least one said pedal comprises a spindle and a tread portion relatively rotatable about the spindle, electricity generating means mounted upon the tread portion and transmission means between the spindle and generator such that for each revolution of the spindle relative to the tread portion the generator undergoes more than one revolution.

Preferably the rotor of the generator is rotatably mounted within the tread portion to rotate about an axis generally parallel with that of the spindle and the generator preferably comprises stator means generally parallel with the spindle and stationary relative to the tread portion.

The transmission means may drive the rotor of the generator via gears at one end of the generator stator.

The transmission means may comprise meshing gear wheels of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator or it may comprise pulleys of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator, said pulleys being connected by an endless belt. The ratio of said gear wheels or of said pulleys is preferably of the order of 2:1.

The said gears are preferably included in a gear box which has a 5:1 output ratio.

The generator and gear box may be arranged in longitudinal alignment within the tread portion on one side of the spindle and a capacitor may be

arranged within the tread portion on the opposite side of the spindle, the capacitor being arranged to store electricity generated by the generator.

One or more arrays of LEDs may be mounted on the tread portion and arranged to be energised by electricity generated by the generator. LEDs exposed to view at one side of the tread portion may differ from LEDs exposed at the opposite side of the tread portion and the weight of the tread portion may be different on opposite sides of the spindle such that it adopts a non-horizontal attitude before a foot is placed upon it. Alternatively, or in addition, the underside of the tread portion may have an outward projection. In this way a cyclist can determine whether a pedal tread portion is the right way round or not (i.e. to offer the correct LED displays in the correct directions) when putting a foot on it. The said difference between the LEDs may be one of colour, number, distribution or any combination of these.

The arrangement is preferably such that the generator has an output of approximately 2 volts when relative rotation between the spindle and tread portion is 30 rpm.

#### BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention will now be described with reference to the accompanying Drawings, in which:

Figure 1 is a longitudinal section through a bicycle pedal assembly in accordance with the present invention,

Figure 2 is a sectional elevation taken on the line II-II of Figure 1, and

Figure 3 is a sectional elevation taken on the line III-III of Figure 1.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The bicycle pedal 20 illustrated in Figure 1 is designed to extend at one end 21 from a crank (not shown) of a bicycle. As is well known per se the bicycle has a second crank similarly equipped with a pedal at 180° to the first, and by placing one foot on each pedal and rotating the cranks the cyclist propels the machine. The pedal comprises a shaft or spindle 1 which will be stationary relative to the associated crank and upon which is

mounted a frame or tread portion 2 to be relatively rotatable by means of bearings 22 and 23. With a cyclists' foot resting on it the tread portion 2 will be held in a horizontal attitude and so for each full revolution of the crank there is one full revolution of the spindle 1 relative to tread portion 2. As so far described the pedal 20 is conventional so that no further description is considered necessary.

In accordance with the present invention, however, there is disposed at the distal end of the spindle 1 and stationary with respect thereto a pulley 4 which is connected by an endless belt 6 to a smaller pulley 5 with a ratio of 2:1. The pulley 5 is at one end of and drives the gears of a gear box 7 which in turn drives the rotor of a generator 3, the gear box having the effect that the rotor of the generator 3 is rotated at five times the speed of the pulley 5. The assembly of gear box 7 and generator 3 is a proprietary product readily available on the market so that no further description thereof is considered necessary. It is housed within the tread 2 on one side of the spindle 1. Housed in the tread 2 on the opposite side of the spindle is a capacitor 8 which is arranged to store electricity generated by the generator 3 so as to continue to energise an array 9 of LEDs, if for only a short time, after the generator ceases to rotate either because the bicycle is stationary or because the cyclist is free-wheeling.

It will be seen that by this arrangement for each full rotation of the crank, and with the tread 2 held horizontal by a foot placed upon its upper surface 14, there will be one full revolution of the pulley 4 relative to the tread 2 and in consequence the rotor of the generator will be rotated at a speed which is a multiple of the speed of rotation of the crank, typically 300 rpm when the rate of rotation of the crank is between 30 and 60 rpm. A speed of rotation of the rotor of the generator of 300 rpm is sufficient to output 2 volts or more, this being the minimum required simultaneously to energise the LEDs 9 and charge the capacitor 8.

The array 9 of LEDs mounted on a circuit board 10 is housed in a lens 13 at the distal end of the pedal tread portion 2 and mirrored surfaces 12 within the lens are arranged to project light beams in the fore and aft direction. Where there is no mirrored surface opposite an LED its light beam is projected laterally outwardly of the bicycle.

In a modification which is not illustrated the mountings of the mirrored surfaces 12 instead of being integral with the material of the lens are free to rotate relative thereto and are eccentrically weighted so that the respective mirrored surface will maintain the same attitude irrespective of the angular position of the pedal. In this way they will project light beams in the fore and aft direction regardless of the pedal orientation.

The light emitted rearwardly may be red and the light emitted forwardly and laterally may be of a different colour, such as white, so that the drivers of other vehicles will know in which direction the bicycle is travelling.

To prevent placing a foot on the pedal with the tread the wrong way round (i.e. so that red light shows forward) the pedal has a projection 15 on its underside which will alert a rider if he places his foot on it and/or the assembly 3,7 is of greater weight than the capacitor 8 so that the pedal assumes a non-horizontal attitude when there is no foot upon it. Preferably the heavier assembly 3,7 is in the rear section 11 of the pedal so that the pedal will tilt backward. When mounting the bicycle the rider will know that the pedal should be tilting backward rather than forward before placing a foot upon it. Pedals according to this embodiment will be supplied in pairs, the two pedals of each pair having oppositely-handed screw threads for engagement with the cranks so that they cannot be fitted the wrong way round.

It will be evident that both pedals of the same bicycle or other pedal driven or pedal equipped vehicle may similarly be provided with electricity generating and/or capacitor and/or LED means. It will also be evident that the electricity generated by the generator 3 might be used instead or additionally to energise some other device such as a sonic alarm.

The present invention provides for the first time a practicable way of achieving that a bicycle or the like will be provided with a lighting or other alarm or alerting system which does not rely either upon batteries or upon the rider remembering to switch it on. The system is an in-built and foolproof safety feature which could be made mandatory for bicycles without unacceptably increasing their cost or having implications for the environment such as arise from the use of batteries. A further advantage is that pedals according to the invention may be offered as replacement or



"retro fit" items, so that existing machines can be equipped with them at little cost as well as new ones.

continued

I claim:

1. Electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, comprising a spindle and a tread portion relatively rotatable about the spindle, electricity generating means mounted upon the tread portion and transmission means between the spindle and generator such that for each revolution of the spindle relative to the tread portion the generator undergoes more than one revolution.
2. Apparatus as claimed in claim 1, wherein the rotor of the generator is rotatably mounted within the tread portion to rotate about an axis generally parallel with that of the spindle.
3. Apparatus as claimed in claim 2, wherein the generator comprises stator means generally parallel with the spindle and stationary relative to the tread portion.
4. Apparatus as claimed in claim 1, wherein the transmission means drives the rotor of the generator via gears at one end of the generator stator.
5. Apparatus as claimed in claim 1, wherein the transmission means comprises meshing gear wheels of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator.
6. Apparatus as claimed in claims 1, wherein the transmission means comprises pulleys of unequal diameter one of which is stationary relative to the spindle and the other of which drives the rotor of the generator, said pulleys being connected by an endless belt.
7. Apparatus as claimed in claim 5 wherein the ratio of said gear wheels is of the order of 2:1.
8. Apparatus as claimed in claim 6 wherein the ratio of said pulleys is of the order of 2:1.
9. Apparatus as claimed in claim 7, wherein the gears are included in a gear box which has a 5:1 output ratio.

11. Electricity generating apparatus for a vehicle equipped with pedals, such as a bicycle, comprising a spindle, means at one end of the spindle for connection to a crank, a tread portion relatively rotatable about the spindle, electricity generating means mounted within the tread portion and laterally of the spindle, transmission means between the spindle and generator such that for each revolution of the spindle relative to the tread portion the generator undergoes more than one revolution and one or more arrays of LEDs disposed at the other end of the tread portion and arranged to be energised by electricity generated by the generator.

13. Apparatus as claimed in claim 12, wherein said mirrored surfaces are mounted within the lens so as to be freely rotatable and each is eccentrically weighted so as to tend to retain the same attitude irrespective of the angular orientation of the pedal.

15. Apparatus as claimed in claim 14, wherein the said difference is in colour.

16. Apparatus as claimed in claim 14, wherein the said difference is in number.

17. Apparatus as claimed in claim 14, wherein the said difference is in spatial distribution.

18. Apparatus as claimed in claim 14, wherein the weight of the tread portion is different on opposite sides of the spindle such that it adopts a non-horizontal attitude before a foot is placed upon it.

19. Apparatus as claimed in claim 14, wherein the underside of the pedal has a projection.

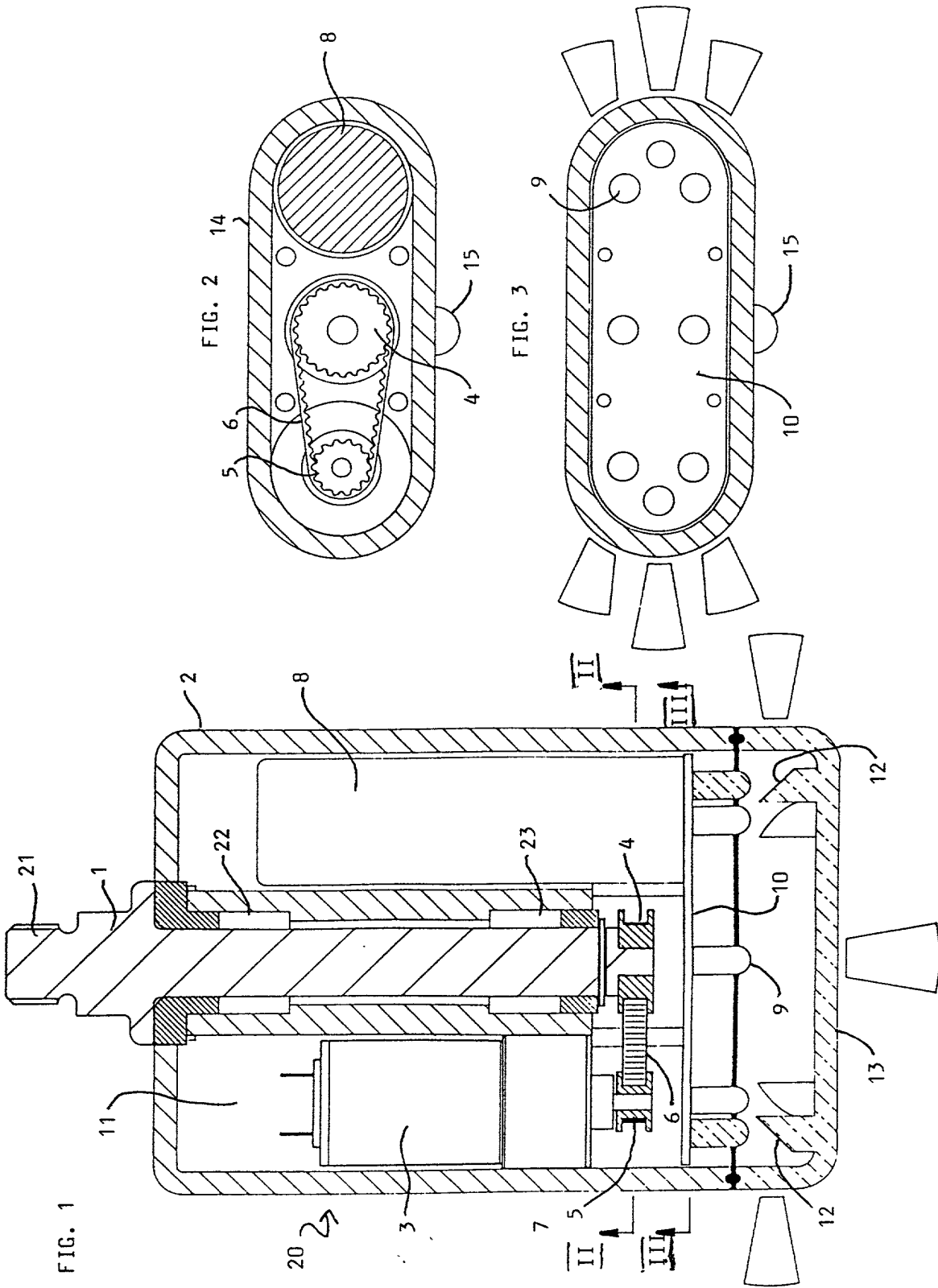
20. Apparatus as claimed in claim 11, wherein the arrangement is such that the generator has an output of approximately 2 volts when relative rotation between the spindle and tread portion is 30 rpm.

2025 RELEASE UNDER E.O. 14176

## ABSTRACT OF THE DISCLOSURE

A generator mounted within the tread portion of a pedal of a bicycle or the like is driven via pulleys of unequal diameter and a gear box so that the speed of rotation of the rotor of the generator is a multiple of the speed of relative rotation between the spindle of the pedal and the tread portion when the latter is held horizontal by a foot resting on it and the crank from which the spindle extends is rotated to propel the bicycle. The gearing up of the generator enables sufficient output voltage to illuminate an array of LEDs and charge a capacitor which will keep them illuminated while the pedal is temporarily stationary.

SECRET



# DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am are the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"ELECTRICITY GENERATION FOR PEDALLED VEHICLES"

the specification of which (check one)

  X   is attached hereto.

       was filed on                       
under Attorney's Docket Number                       
as Application Serial No.                       
and was amended on                      (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

9802026.6      United Kingdom      02:02:1998  
(Number)      (Country)      (Filing Date)

yes Yes        No

                                                                          
(Number)      (Country)      (Filing Date)

       Yes        No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, we acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

                      
(Appln. Serial No.)

                      
(Filing Date)

                      
(Status)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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FULL NAME OF INVENTOR: RICHARD BANFIELD HICKS

INVENTOR'S SIGNATURE: Richard Banfield Hicks DATE: 7 January 1999

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CITIZENSHIP:

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FULL NAME OF INVENTOR:

INVENTOR'S SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

RESIDENCE:

CITIZENSHIP:

POST OFFICE ADDRESS: